UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE RO

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REPLY TO: 3420 DATE: January 13, 1988

SUBJECT: Evaluation of Ponderosa Pine Plantation Scorched by Fire on Ukonom Ranger District (Report No. 88-1)

TO: Forest Supervisor, Klamath National Forest

The extensive burns during 1987 were largely confined to mature timber, although some plantations and regeneration were involved. Stand 19-1 on the Ukonom Ranger District is a ponderosa pine plantation along the Ti Bar Road that was scorched by backfires. The plantation was examined to determine its potential for survival on 11/18/87 by Dave Schultz, entomologist, John Kliejunas, plant pathologist, and Stan Marshall, project forester.

Stand 19-1 was planted with ponderosa pine about 20 years ago. Survival and growth both appear to have been quite good, in spite of heavy competition from tanoak, chinkapin and snowbrush. Forest cover in the general area is largely Douglas-fir, with small amounts of white fir, incense-cedar and sugar pine. Some Douglas-fir, white fir and incense-cedar have seeded into the plantation. Some of the scattered Douglas-fir volunteers are beginning to overtake the planted ponderosa pine. There was an attempt to chemically thin the pine and kill some of the larger tanoak sprouts at some point in the past. Most of the treated trees remained alive until scorched by the fire.

The injured trees in the plantation can be categorized into three broad classes; trees killed immediately by the fire, trees visibly injured and trees with insignificant or no injury. Most of the trees in "hotspots" ranging from about 1/4 to 5 acres in size, as well as some individual trees, were killed immediately by the fire. These trees are characterized by extensive charring of the bark and foliage that is either missing or "frozen" in an upslope position by the heat. If the heat was intense enough to kill the branches, any remaining foliage is usually a dark mottled brown. There had been some limited attacks on these trees by western pine beetle, Dendroctonus brevicomis, and red turpentine beetle, D. valens. These attacks will not result in any brood being produced because the sapwood will turn sour before bark beetle larvae can develop. The only insects that will develop in these trees are woodborers, which will pose no threat to living trees.

The largest category of trees in the plantation are those which are still alive, but have been injured to some degree. The injuries consist of various combinations of buds, foliage and patches of cambium being killed. As a general rule, those pines which stand the greatest chance of surviving a fire have 50 percent or more of the crown(buds) still alive and 50 percent or more of the

circumference of the cambium at the base of the tree still alive. If the foliage of a tree is still green, it is generally safe to assume that the buds are still alive in that portion of the crown. In a late season fire, such as this one, the buds of ponderosa pine have already been set and are generally protected by the foliage. Even if all of the foliage has been killed by heat, many trees will have live buds in part of the crown which will flush the following spring. Heat-killed foliage on branches which still have live buds tends to hang in a fairly normal position and is a uniform reddish-brown.

Although there will be many living trees in the plantation in the spring of 1988, a substantial portion of the trees will be weakened and susceptible to attack by bark or engraver beetles, Ips spp. The most seriously injured trees are the most likely to come under initial attack by bark or engraver beetles. If the initial attacks are successful, the attacking beetles release a pheromone which will attract additional beetles toward the area. Once large numbers of beetles are near the tree under attack, they may be capable of attacking and killing other trees within 20-30 feet, whether the adjacent trees are injured or healthy. In this way, some of the most severely injured (but still living) trees present a threat to adjacent trees in the plantation.

Theoretically, it would be possible to lower the risk of bark and engraver beetle attacks by taking action to make these severely injured trees unavailable or unsuitable for beetle breeding habitat. If the trees were felled, limbed and bucked by mid-January, 1988, the phloem would probably deteriorate before it could be utilized by beetles. It would also be effective to remove the trees from the site or destroy the trees by burning or chipping, or to prevent infestation by applying insecticide before mid-May. In reality, the risk of extensive mortality in the plantation caused by bark or engraver beetles is fairly low and the degree of expertise and effort required to lower it furtner is quite high.

It would take some training and an investment of several minutes per tree to discriminate between the dead, severely injured and moderately injured trees. When this investment is added to the relatively slow production that should be anticipated because of dense brush, the total cost may be quite high. The benefits are likely to be low for several reasons. Because of the pattern of the burn, some of the most severely injured trees are not close enough to any moderately injured or uninjured trees to pose a threat. In addition, some of the injured trees may be less susceptible to bark beetle attack than they initially appear. The burn killed some trees and acted as a thinning agent. It also killed the above ground portion of much of the competing vegetation which will make more moisture available to the surviving trees for a year or two. The benefits of treating young trees injured by fire would also be expected to be low based on the historical record. The largest concentrations of plantation trees killed by bark or engraver beetles to date have generally been less than an acre in size and have involved a relatively small percentage of the plantation area. Both plantation trees in general and, more specifically, fire-injured trees of all sizes, have never caused a buildup of bark or engraver beetles which have spread to and significantly damaged surrounding green timber in California.

The third broad category of trees in the plantation are those that were uninjured or barely touched by the fire. A visual estimate of the uninjured trees outside the major hotspots was about 100 trees per acre. Most of these

trees should survive, with the exception of a few uninjured trees located adjacent to a severely injured tree.

Management Alternatives

1. Do Nothing. With the exception of a few hotspots, there should be enough trees left to fully occupy the site by rotation. Some intermediate harvests will be forgone due to low stocking at younger ages. Some severely injured trees may show chronic poor vigor and poor growth for decades. Irregular stocking, chronic health problems and occasional mortality may cause a decision to harvest the stand sooner than initially anticipated. Costs would be minimal for many decades.

2. Eliminate Severely Injured Trees Immediately. Proper treatment of the most severely injured trees to prevent bark and engraver beetle attacks may prevent an unknown amount of mortality of the less severely injured plantation trees during 1988 and 1989. It is difficult to predict whether any mortality will occur, and if so, which portions of the plantation would be involved. To effectively protect the plantation, 100 percent of the area affected by the burn would have to be treated. Based on past experience, the maximum benefit would be to prevent an additional 5 percent, or less, of the plantation from being killed. If the timing or disposal methods for the slash are not adequate, pine engravers may build up in the slash and cause greater mortality than if no action is taken. Costs should be at least as high or higher than for precommercial thinning.

3. Replant Hotspots as Quickly as Possible. The hotspots currently have less vegetative competition than they are likely to have at any point in the future. The few remaining charred tree and brush stems are not dense enough to seriously interfere with planting and may be beneficial as dead shade. Spots smaller than about 1/4 acre are probably not profitable to plant. Only shade tolerant species such as white fir are likely to survive in the smaller openings, and it may be near the lower elevational limit where it will perform well. In addition, the smaller openings will be almost completely occupied by the roots and crowns of the surrounding trees before rotation. The larger spots can be planted with almost any species native to the general area. Because the plantation is almost entirely ponderosa pine, the use of other species for new plantings would add diversity and lower the risk of some future pest-caused losses. Sugar pine should be avoided unless blister rust resistant stock is available. Avoid planting Douglas-fir if Douglas-fir dwarf mistletoe is present in the adjacent natural stand. The cost per tree or per acre would probably be quite high if planting was accomplished by standard contracting techniques. The small size and discrete nature of the spots may lend well to planting by volunteers interested in the rehabilitation effort, youth group projects or force account labor.

4. Thin and Release Remaining Trees. If the remaining trees are to be carried to rotation, they would benefit from selective thinning and release from competing vegetation. These operations would offset some of the lingering effects of cambial injuries and loss of photosynthetic surface in the crown. The rotation would probably be shortened, but the major benefit would be to prevent some of the potential crop trees from being killed by bark or engraver beetles. There would be little need for these treatments for several years

until moisture stress increases as tree crowns develop again and the brush sprouts from root crowns. It may be counterproductive to thin too early because early thinning or release could cause an investment in stems that will die later, or remove some stems that might be useful at a later date. In spite of a low number of stems per acre to be cut, costs would probably be just as high as a standard thinning or manual release contract.

5. Prepare Site and Replant. If the site were completely cleared, it might be possible to reduce the vegetative competition, depending on the methods used and amount of time and money invested. It may not be desirable to clear a large area for several years, however, because so much land in the watershed has already been disturbed by the burn. Replanting would offer the theoretical advantages of greater control over stocking and species composition, although it may require precommercial thinning to fully capture these advantages. One advantage of a greater number of stems is the possibility of earlier financial returns through intermediate harvests. Because the returns won't occur for many decades after planting, and the initial harvests will result in low volumes per acre, it is generally not economical to replace an existing plantation which is still above minimal stocking. A difficult to quantify advantage of replacing the fire scorched plantation is that the replacements would have fewer injuries and would probably have a more thrifty appearance. Replacing the plantation would likely save a certain amount of time and money over the rotation that would otherwise be spent on concern, stand examinations, reports and sanitation and salvage efforts as the damaged trees show signs of poor vigor or mortality. The cost of site preparation and replanting would be at least $300-400 per acre and the first major benefits would occur about the same time that the current plantation approaches rotation.

The observations and alternatives developed for this evaluation are probably applicable to other plantations or aggregations of young natural ponderosa or Jeffrey pine scorched by fire. Other tree species which have thinner bark and less protected buds would be expected to show greater injury and mortality in response to the same intensity burn.

If you have further questions or would like to discuss the alternatives presented, please call Dave Schultz at 415-556-4322.

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